Name: _____

Class: _____

Date: _____

Chemical Analysis part 2 AQA Triple Chemistry

Time: **81 minutes**

Marks: **81 marks**

Comments:

1. Many human activities result in carbon dioxide emissions.
Our carbon footprint is a measure of how much carbon dioxide we each cause to be produced.

(a) Why should we be concerned about our carbon footprint?

_____

_____

_____

(1)

(b) Most power stations in the UK burn coal.
Coal was formed from tree-like plants over millions of years.

Suggest why burning wood instead of coal would help to reduce our carbon footprint.

_____

_____

_____

_____

_____

_____

_____

_____

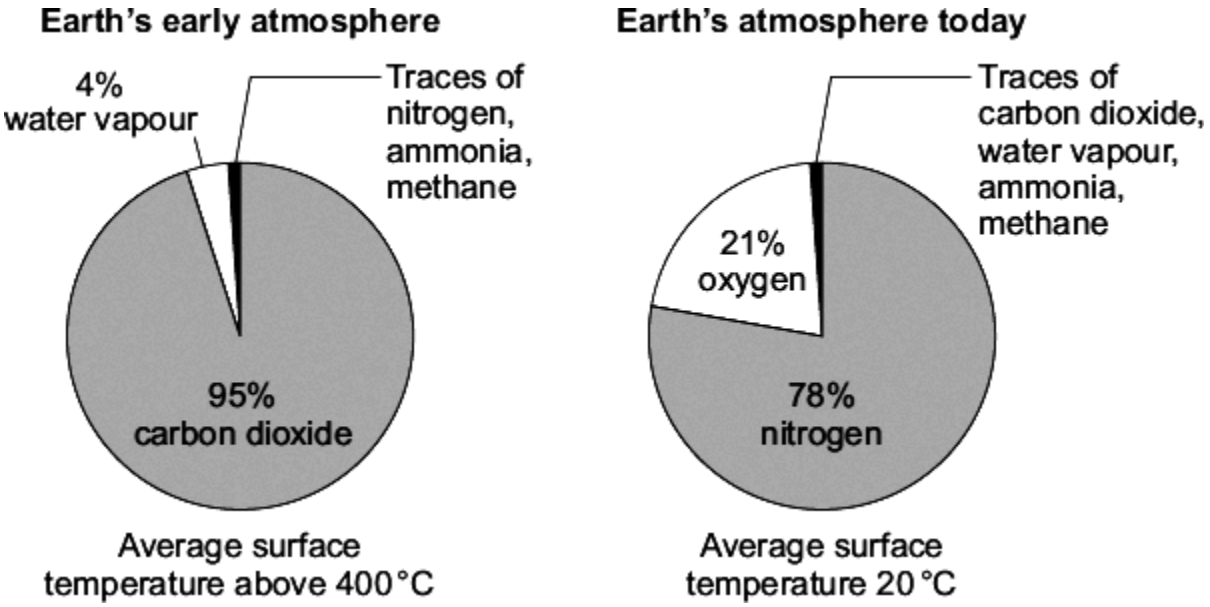
(3)

(Total 4 marks)

2. (a) Scientists have suggested that:

- the Earth formed as a molten ball of rock and minerals
- the rock and minerals cooled slowly
- the surface of the Earth was covered by volcanoes
- the volcanoes released gases that formed the Earth's early atmosphere.

The pie charts show the approximate percentages of gases in the Earth's early atmosphere and in the Earth's atmosphere today.



(i) Explain what has happened to most of the water vapour in the Earth's early atmosphere.

_____

_____

_____

_____

(2)

(ii) Give **two** reasons why the percentage of carbon dioxide in the Earth's early atmosphere decreased.

1. _____

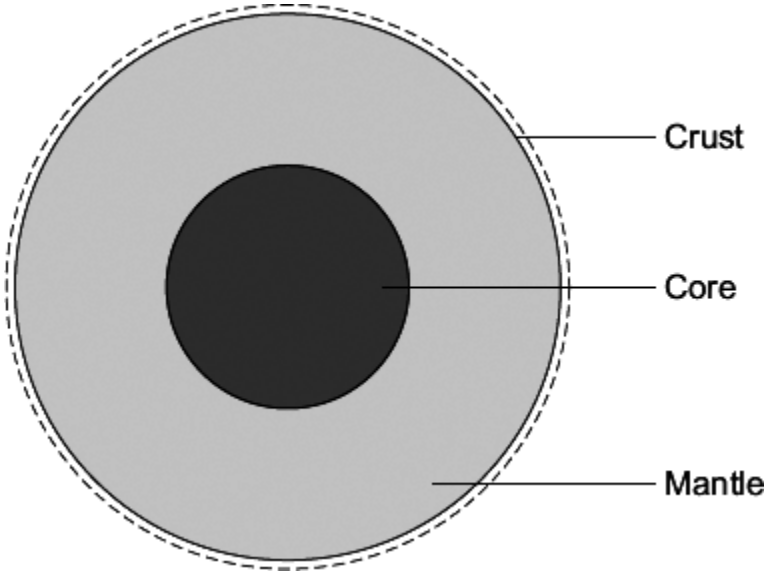
_____

2. _____

_____

(2)

(b) Scientists have suggested that the Earth consists of a core, mantle and crust.



A 'traditional' theory is that the core is made of iron and nickel.

A 'controversial' theory is that the core is like a nuclear reactor made of the radioactive elements uranium and plutonium.

(i) Why can scientists **not** prove which theory about the core is correct?

_____

_____

(1)

(ii) How can the 'controversial' theory be used to explain why the Earth's tectonic plates move?

_____

_____

_____

_____

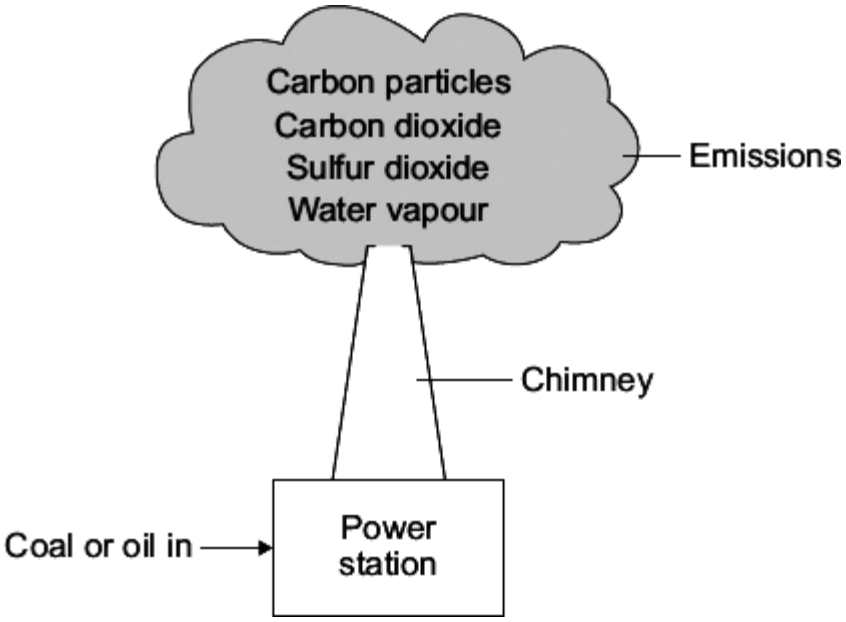
_____

_____

(3)

(Total 8 marks)

3. In the future more coal-fired and fewer oil-fired power stations will be used to generate electricity. When coal and oil are burned they produce the same types of emissions which can cause environmental problems.



(a) Emissions from the chimney can cause acid rain, global dimming and global warming. Draw **one** straight line from each possible environmental problem to the emission that causes it.

Possible environmental problem	**Emission that causes it**
acid rain	carbon particles
global warming	carbon dioxide
global dimming	sulfur dioxide
	water vapour

(3)

(b) Draw a ring around the correct word in the box to complete each sentence.

(i) Incomplete combustion of coal or oil is caused by too little

carbon dioxide.
nitrogen.
oxygen.

(1)

(ii) A gas formed by the incomplete combustion of coal or oil is

carbon monoxide.
hydrogen.
oxygen.

(1)

(c) The table shows the world production for both coal and oil in 2000.

The world production figures after 2000 are predicted.

Year	**World production of coal (billions of tonnes per year)**	**World production of oil (billions of barrels per year)**
2000	3.5	12.5
2050	4.5	5.6
2100	5.0	1.7
2150	5.5	0.5
2200	6.0	0.0

(i) How is the world production of oil predicted to change from 2000 to 2200?

_____

_____

(1)

(ii) Suggest **two** reasons why the world production of coal is predicted to increase.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

4. Billions of years ago, the Earth's early atmosphere was probably like the atmosphere of Venus today.

The table shows a comparison of the atmospheres of the Earth and Venus today.

	Percentage composition of atmosphere	
Name of gas	**Earth today**	**Venus today**
Nitrogen	78	3.5
Oxygen	21	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
Average surface temperature	20 ºC	460 ºC

(a) Use the names of gases from the table to complete the sentences.

(i) In the Earth's atmosphere today, the main gas is _____ .

(1)

(ii) In the Earth's atmosphere billions of years ago, the main gas was

_____.

(1)

(b) (i) Scientists do **not** know the accurate composition of the Earth's early atmosphere. Suggest why.

_____

_____

(1)

(ii) Use information from the table to answer this question.

Water vapour is present in the atmospheres of the Earth and Venus today.
The Earth's surface is mainly covered by water.

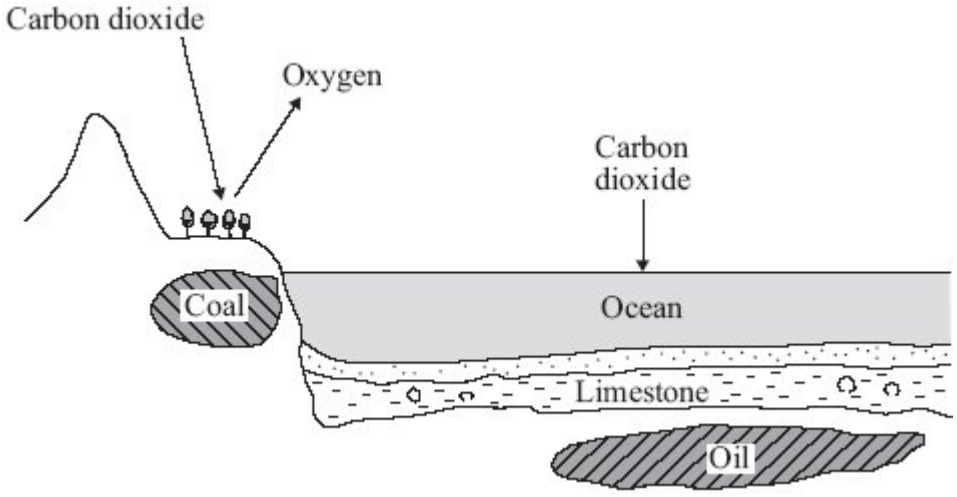
Suggest why there is no water on the surface of Venus.

_____

_____

(1)

(c) The diagram shows how carbon dioxide is removed from the Earth's atmosphere.



Describe what happened to the carbon dioxide in the Earth's early atmosphere.
Use the diagram to help you.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

5. There are many ideas about the formation of the Earth and its atmosphere from a molten ball of rock and minerals.

(a) One idea is that the Earth's early atmosphere and average surface temperature were probably like that of Venus today.

The table shows information about the Earth and Venus today.

	Percentage composition of atmosphere	
Name of gas	**Earth today**	**Venus today**
Nitrogen	78	3.5
Oxygen	21	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
Average surface temperature	20 °C	460 °C

There is a variable amount of water vapour in both atmospheres.

(i) How was the Earth's early atmosphere formed?

_____

_____

(1)

(ii) The Earth's average surface temperature decreased over time. At what temperature would oceans have started to form?

Temperature = _____ °C

(1)

(iii) Describe how the evolution of plants changed the Earth's atmosphere.

_____

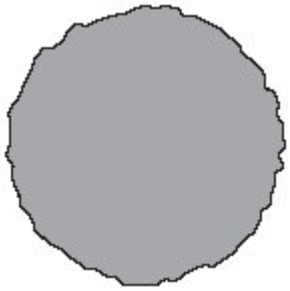
_____

_____

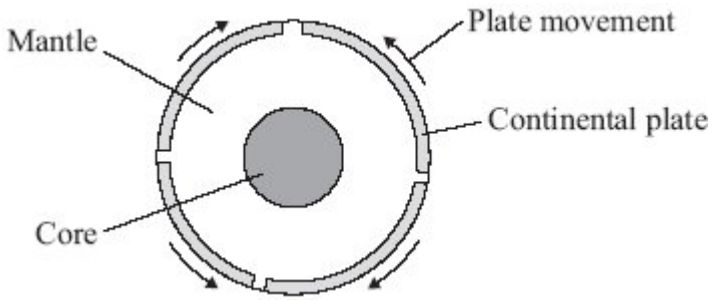
_____

(2)

(b) Another idea was that the Earth's mountains and continents formed in fixed positions as the molten ball of rock and minerals cooled and wrinkled.



Wegener, in 1915, had the idea that the Earth's crust and the upper part of the mantle had cracked into plates that were able to move. His idea meant that the mountains and continents were not in fixed positions.



(i) Give **one** piece of evidence that led to Wegener's idea being accepted.

_____

_____

(1)

(ii) Describe what causes the Earth's tectonic plates to move.

_____

_____

_____

_____

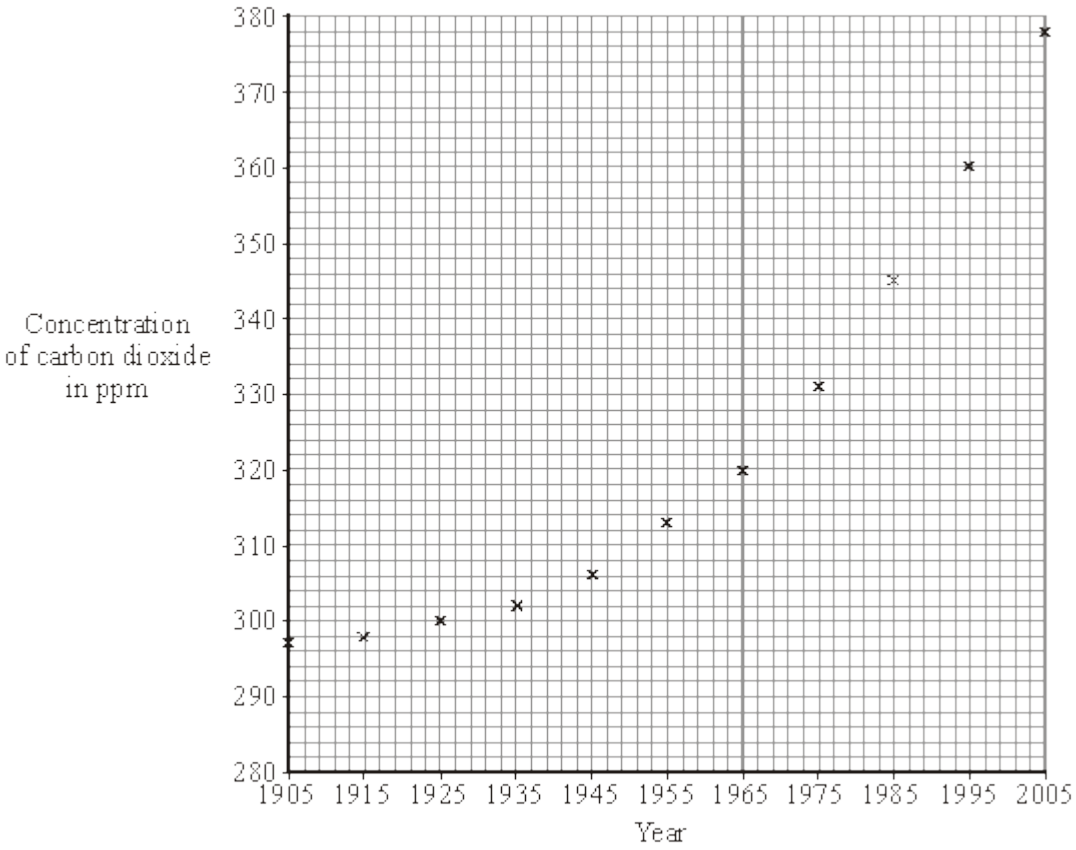
_____

_____

(3)

(Total 8 marks)

6. Global warming is thought to be happening because of the increased burning of fossil fuels. The concentration of carbon dioxide in the air from 1905 to 2005 has been calculated.



(a) Draw a line of best fit for these points.

(1)

(b) (i) What was the concentration of carbon dioxide in 1955?

_____ ppm

(1)

(ii) In what year did the concentration of carbon dioxide reach 350 ppm?

_____

(1)

(c) Use the graph to describe, in as much detail as you can, what happened to the concentration of carbon dioxide from 1905 to 2005.

_____

_____

_____

_____

(2)

(Total 5 marks)

7. Scientists study the atmosphere on planets and moons in the Solar System to understand how the Earth's atmosphere has changed.

(a) Millions of years ago the Earth's atmosphere was probably just like that of Mars today.

The table shows data about the atmospheres of Mars and Earth as they are now.

Mars		**Earth**	
nitrogen	3%	nitrogen	78%
oxygen	trace	oxygen	21%
water	trace	water	trace
carbon dioxide	95%	carbon dioxide	trace
Average surface temperature –23 °C		Average surface temperature 15 °C	

Suggest what has caused the main gases in the Earth's atmosphere of millions of years ago to change to the present-day atmosphere.

_____

_____

_____

_____

(2)

(b) Titan is the largest moon of the planet Saturn. It has an atmosphere that, like the Earth's, contains mainly nitrogen. Methane is the other main gas.

Main gases in Titan's atmosphere	**Percentage (%)**	**Boiling point in °C**
Nitrogen	95	–196
Methane	5	–164
Average surface temperature –178 °C		

When it rains on Titan, it rains methane! Explain why.

_____

_____

_____

(2)

(c) Ultraviolet radiation from the Sun produces simple alkenes, such as ethene and propene, from methane in Titan's atmosphere.

(i) Draw the structure of propene, C_3H_6, to show the covalent bonds.

(1)

(ii) Explain how propene molecules form a polymer. You should name the polymer formed.

_____

_____

_____

_____

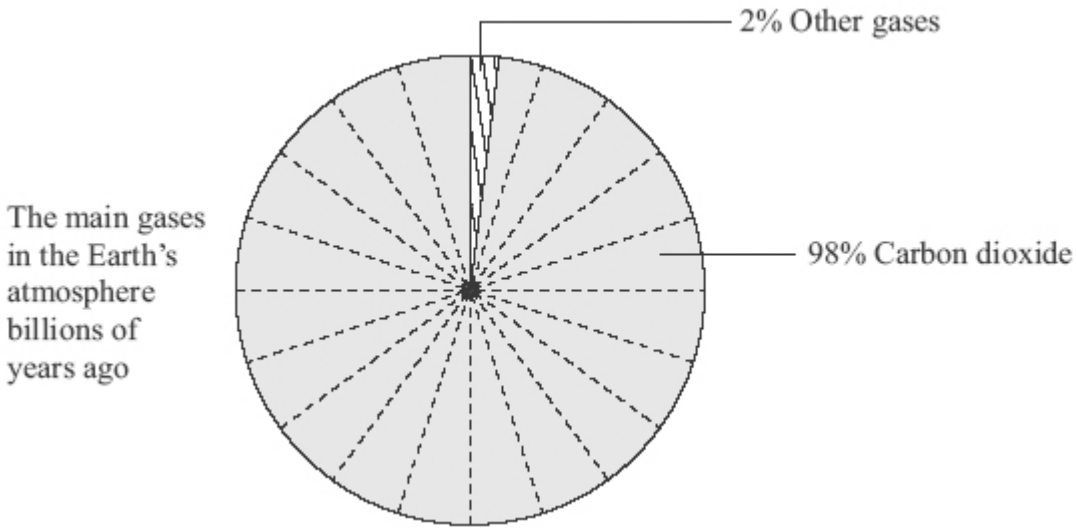
_____

_____

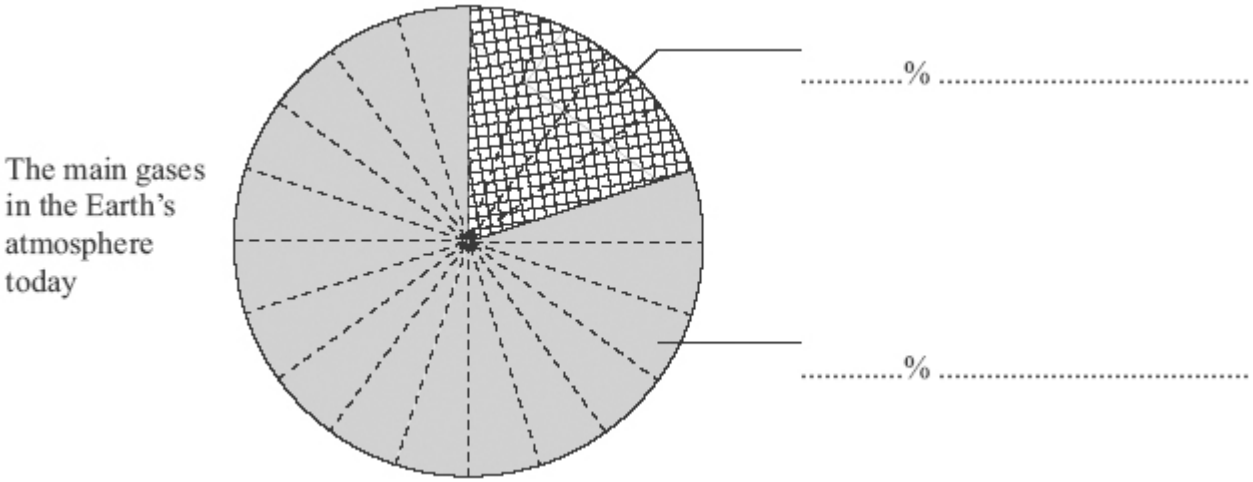
(3)

(Total 8 marks)

8. Life on Earth would not exist without the atmosphere. Billions of years ago the composition of the Earth's atmosphere was very different from the composition today.



(a) Label the pie chart below to show the percentages and names of the two main gases in the Earth's atmosphere today.



(2)

(b) There is evidence that the composition of the Earth's atmosphere is still changing. One possible reason is that many power stations generate electricity by burning fossil fuels such as coal, oil or natural gas. Sulfur dioxide, SO_2, is produced when coal burns in air.

(i) What environmental problem does sulfur dioxide cause?

_____

_____

(1)

(ii) How could this environmental problem be reduced in coal-fired power stations?

_____

_____

(1)

(iii) Gas-fired power stations burn methane, CH_4, in air.

Complete the word equation for this reaction.

methane + _____ → carbon dioxide + _____

(2)

(c) Excess carbon dioxide should be prevented from entering the atmosphere.

Explain why.

_____

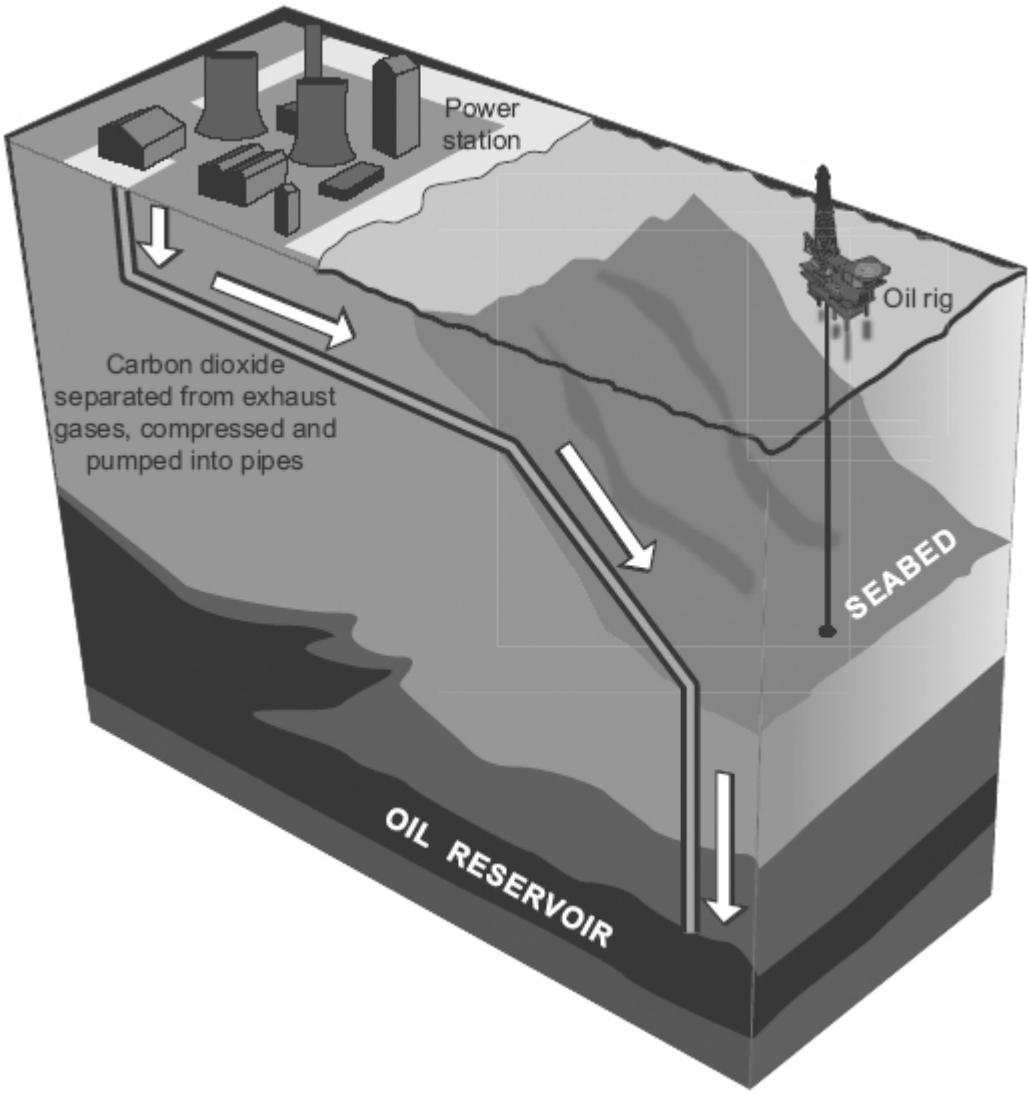
_____

_____

_____

(2)

(d) Carbon dioxide is produced when fossil fuels burn in power stations. The diagram represents one idea to prevent excess carbon dioxide from entering the atmosphere.



Use the diagram to explain how carbon dioxide can be prevented from entering the atmosphere.

_____

_____

_____

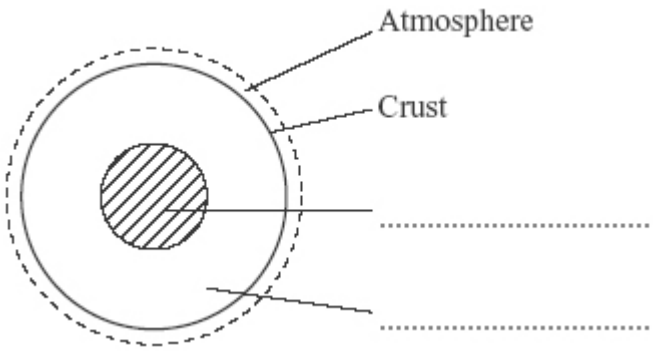
_____

(2)

(Total 10 marks)

9. The Earth is shaped like a ball and is surrounded by an atmosphere.

(a) The diagram shows the layered structure of the Earth.



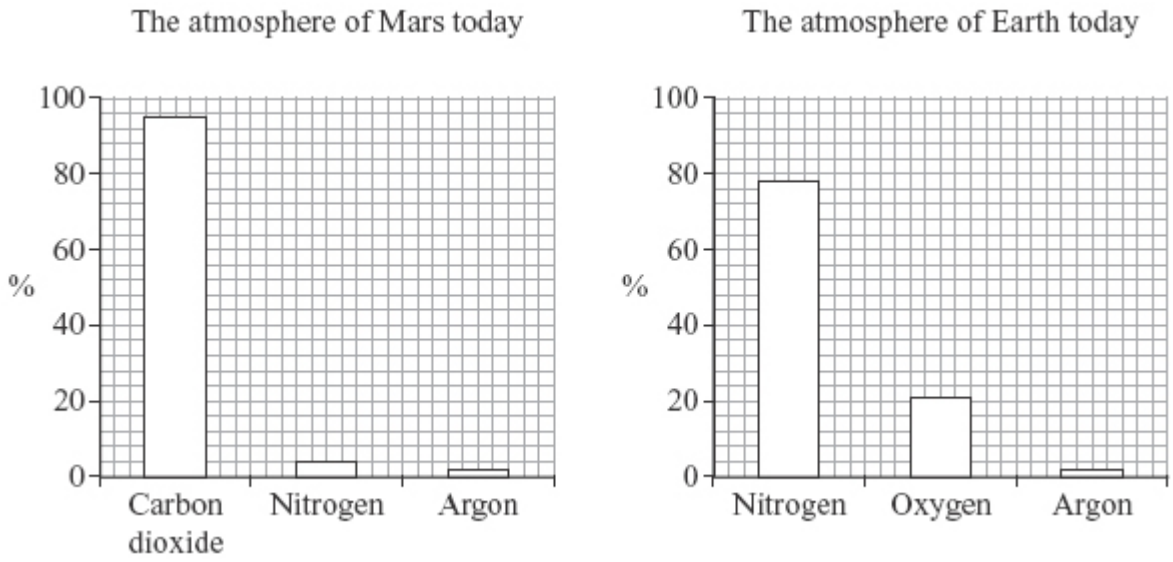
Choose words from the box to complete the labels on the diagram.

core	**mantle**	**plate**

(2)

(b) Some theories suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

The bar charts show the three most common gases in each atmosphere today.



(i) Use the bar charts to complete the sentence by writing in the correct gases.

In the atmosphere of Mars today there is mainly _____

and no _____ .

(2)

(ii) Use the bar charts to complete the sentence by writing in the correct number.

These theories suggest that there was about _____ % nitrogen in the Earth's early atmosphere.

(1)

(iii) The atmosphere of the Earth today has much more nitrogen than in the early atmosphere. Denitrifying bacteria released most of this nitrogen into the atmosphere.

There are other differences between the Earth's early atmosphere and the atmosphere of the Earth today.

Use the bar charts to describe and explain **two** of these other differences.

_____

_____

_____

_____

_____

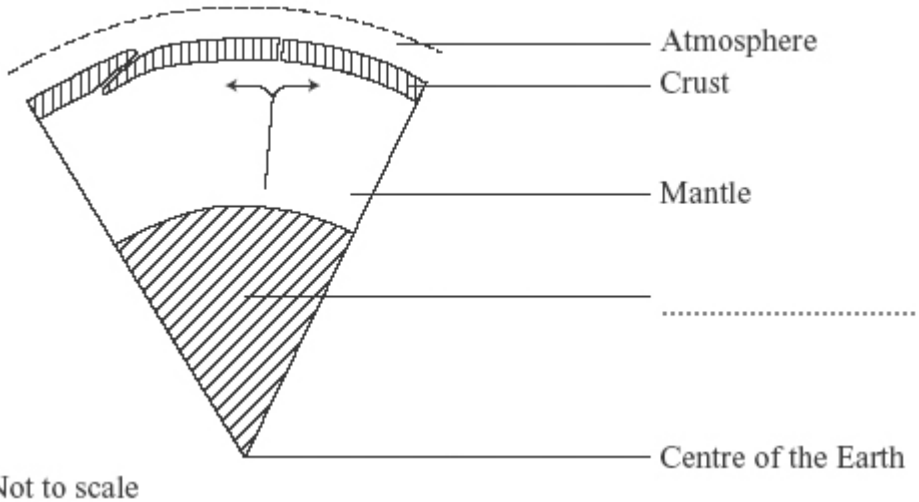
_____

(3)

(Total 8 marks)

10. The Earth is shaped like a sphere and is surrounded by an atmosphere.

(a) The diagram shows a section of the layered structure of the Earth.



(i) Complete the diagram by writing in the missing label.

(1)

(ii) Earthquakes within the Earth's crust can be sudden and disastrous. Scientists cannot accurately predict when earthquakes will occur.

Explain why.

To obtain full marks you must support your answer with a description of what causes earthquakes.

(4)

(b) Some theories suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

Gases	The atmosphere of Mars today	The atmosphere of Earth today
Carbon dioxide %	95	0.03
Nitrogen %	3	
Argon %	1.5	0.97
Oxygen %	0.5	21

(i) Complete the table by writing in the percentage of nitrogen in the atmosphere of Earth today.

(1)

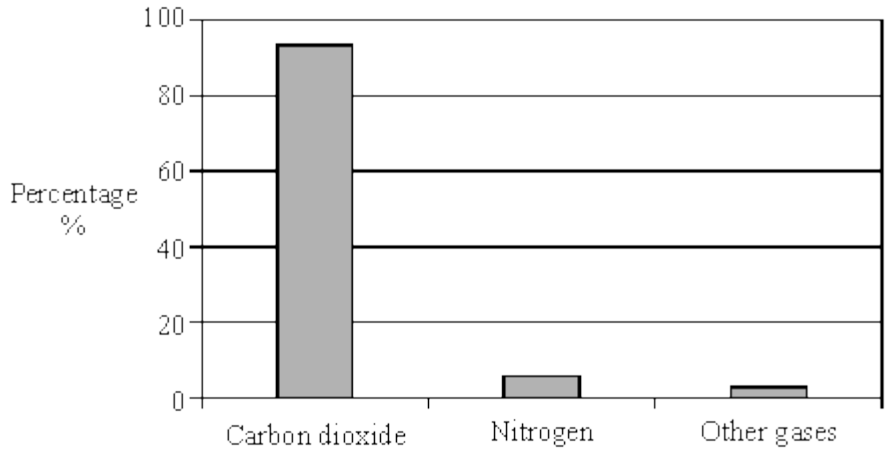
(ii) Use the information in the table to describe the changes that have happened to **two** of the gases in the Earth's atmosphere.

Explain what has caused these changes.

(4)

(Total 10 marks)

11. The bar chart shows the percentage composition of the atmosphere on Mars.



(a) State **three** ways in which the atmosphere on Earth today is different from that on Mars.

1 _____

_____

2 _____

_____

3 _____

_____

(3)

(b) The atmosphere on Earth may once have been like that on Mars. The evolution of green plants has changed the atmosphere on Earth.

Explain why.

_____

_____

_____

_____

(2)

(Total 5 marks)

1.

(a) (thought to cause) global warming / green house (effect) / climate change

ignore other consequences of global warming

*do **not** accept acid rain / ozone layer / global dimming*

1

(b) any **three** from:

- replant trees / renewable / sustainable

  ignore reusable

- carbon (dioxide) used by trees / photosynthesis

  accept trees absorb carbon (dioxide) as they grow

  ignore respiration

- it is a (continuous / carbon) cycle

  accept burning wood is carbon neutral

  or

  carbon (dioxide) goes back into the air

  *for the **second** and **third** bullet points: accept trees use carbon dioxide which is released when (trees / wood are / is) burnt for **2** marks*

- no new carbon (dioxide) is produced

  or

  no locked up carbon (dioxide) is released

  or

  the carbon (dioxide) was absorbed millions of years ago

3

[4]

2.

(a) (i) *it = water vapour*

condensed

accept temperature went <u>below</u> <u>100</u>°C / boiling point of water

allow <u>cooled to form liquid</u> / water / rain

*do **not** accept evaporated*

1

formed the oceans / seas

ignore rain

*accept (water vapour) cooled and formed the ocean / sea for **2** marks*

1

(ii) any **two** from:

ignore oxygen / nitrogen increased

ignore reference to volcanoes / respiration

- used by (green) plants / *algae*
  accept photosynthesis / plants give out oxygen
- changed into oxygen
- dissolved in oceans / seas
  accept (locked up) in shells / skeletons (of animals)
- (locked up) in carbonates / sedimentary rocks
- (locked up) in fossil fuels / named fossil fuel

2

(b) (i) cannot get to / reach / drill to / see the core

accept the core is (too) far down (into the Earth) / do not know what happens under the crust / Earth's surface

accept it is (too) hot / radioactive

ignore lack of evidence unqualified

1

(ii) any **three** from:

- heat / *energy* released
- from radioactive decay / processes
  accept radioactivity / nuclear reactions
- (causing) convection currents
- in the mantle

3

[8]

3. (a) acid rain → sulfur dioxide

1

global warming → carbon dioxide

1

global dimming → carbon particles

1

(b) (i) oxygen

1

(ii) carbon monoxide

1

(c) (i) decreasing

accept running out / none left

1

(ii) any **two** from:

it = coal

- world needs (more) energy

  accept population is increasing

  allow (greater) demand for coal / fuels / energy

- plentiful supply

  accept readily available

  allow coal will 'last longer'

- (many) countries have coal
- easy to find / extract
- oil / gas is running out

  accept need to use less oil / gas

  accept need to use it to replace oil / gas

- cheap **or** cheaper than oil

2

[8]

4. (a) (i) nitrogen / N_2

1

(ii) carbon dioxide / CO_2

1

(b) (i) humans / scientists had not evolved

accept it was billions / millions of years ago

allow too long ago

1

(ii) temperature is above 100°C **or** any water would evaporate / boil

accept Venus is too hot

1

(c) any **three** from:

- used by plants
- used for photosynthesis

  *accept plants take in carbon dioxide and give out oxygen for the first two bullet points ie **2** marks*
- dissolves in oceans / seas

  allow absorbs into oceans / seas
- used to form the shells / skeletons of marine organisms
- locked up as limestone / carbonates
- locked up as fossil fuels / oil / coal

3

[7]

5. (a) (i) (gases from) volcanoes

1

(ii) 100 allow 99

1

(iii) any **two** from:

- photosynthesis
- carbon dioxide used

  allow carbon dioxide decreased
- oxygen produced

  allow oxygen increased

  ignore nitrogen / respiration

  they = plants

2

(b) (i) any **one** from:

- sea floor spreading

  accept oceanic ridges / magnetic stripes
- periodic measurements between continents

  accept continents move a few centimetres each year
- evidence from rocks / fossils on different continents

  accept continents fit together
- new mountain ranges

  accept new islands

1

(ii) in the mantle

any **two** from:

- convection (currents) / movement
  *do **not** accept movement of the plates*
- radioactivity / radioactive decay / nuclear reactions

1

- releases heat / thermal energy
  accept heat from core

2

6. (a) curve of best fit drawn through

or close to all of the points

1

(b) (i) 313

1

(ii) 1989 +/– 1

1

(c) concentration / amount of carbon dioxide has increased

1

recently the rate of increase is increasing

1

[5]

7. (a) any **two** from:

asks for cause therefore no marks for just describing the change

must link reason to a correct change in a gas

carbon dioxide has <u>decreased</u> due to:

accept idea of 'used' to indicate a decrease

- plants / micro organisms / bacteria / vegetation / trees
- photosynthesis

  ignore respiration
- 'locked up' in (sedimentary) rocks / carbonates / fossil <u>fuels</u>
- dissolved in oceans

  ignore volcanoes

oxygen has <u>increased</u> due to:

accept idea of 'given out / produced'

- plants / bacteria / micro organisms / vegetation / trees
- photosynthesis

  ignore respiration

nitrogen <u>increased</u> due to:

accept idea of 'given out / produced'

- ammonia reacted with oxygen
- bacteria / micro organisms

  ignore (increase in) use of fossil fuels / deforestation

2

(b) (because methane's) boiling point is greater than the average / surface temperature **or** Titan's (average / surface) temperature is below methane's boiling point

*ignore references to nitrogen **or** water*

1

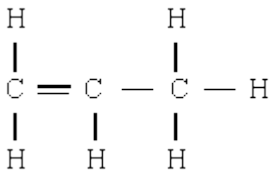
any methane that evaporates will condense

accept boils for evaporates

accept cooling and produce rain for condensing

1

(c) (i)



bonds must be displayed correctly

ignore bond angles

1

(ii) poly(propene) / polypropene / polypropylene

*do **not** allow polypropane*

any **two** from:

- double bonds open up / break / become single(*)
- propene molecules / monomers / they join / undergo addition polymerisation(*)

1

- form chains / long molecules(*)

*(*)correct chemical equation gains **2** marks*

ignore large

*using monomer incorrectly max **2** marks*

2

8. (a) oxygen **and** nitrogen

1

20 – 21 % and 78 – 80 %

*accept any two correct responses in the correct space for **one** mark*

1

(b) (i) acid rain

accept toxic gas or consequence of acid rain

1

(ii) idea of the removal or use of sulfur dioxide gas (from the waste gases)

*do **not** accept remove sulfur from coal*

1

(iii) oxygen

accept O_2

1

water

accept H_2O

accept hydrogen oxide / steam

1

(c) any **two** from:

- it's a 'greenhouse gas' or increase greenhouse effect
  accept action of a 'greenhouse gas'
- causes global warming or increase in the Earth's temperature
- sea-levels rise or flooding
- climate change
- (polar) ice-caps melt
- extension of deserts
  *mention of ozone / acid rain / global dimming = max **1** mark*

2

(d) idea trap / store / lock the carbon dioxide

1

in the oil reservoir or under the sea bed
*do **not** accept 'into the oil' / 'under the sea'*

1

[10]

9. (a) core
ignore outer or inner

1

mantle

1

(b) (i) carbon dioxide

accept formula CO_2

1

oxygen

accept formulae O_2 / O

1

(ii) 4%

1

(iii) carbon dioxide has <u>decreased</u> / from 95% to 0%

1

oxygen has <u>increased</u> / from 0% to 21%

1

any **one** from:

(carbon dioxide decrease)

- carbon dioxide used during photosynthesis / by plants
- carbon dioxide dissolves in oceans
- carbon dioxide is locked up in rocks / carbonates / fossil fuels

(oxygen increase)

- oxygen released during photosynthesis / by plants

1

10. (a) (i) core

1

(ii) plate (boundaries)

accept parts of the crust

ignore crust alone

1

sudden movement / colliding

accept movement but ignore movement apart

or

normally move a few centimetres per year

accept continental drift

1

convection currents / driven by heat from radioactive processes / decay

idea of source of energy for the movement

1

the idea of uncertainty with an explanation

eg scientists do not know (with any certainty)

- what happens under the crust
- where the forces / pressure are building up
- we cannot measure the forces
- when the forces reach their limit

ignore references to volcanoes

1

(b) (i) 78

(ii) marks awarded for any 2 gases from the following 3 gases

*max **3** marks from CO_2*

1

any **four** from:

ignore references to respiration

carbon dioxide has decreased:

- used by plants / bacteria (stromatolites)
- during photosynthesis (must be linked to CO_2 decrease)
- 'locked up' in (sedimentary) rocks / carbonates / fossil fuels
- dissolved in oceans

and / or

oxygen has increased because:

- released by plants / bacteria (stromatolites)
- during photosynthesis (must be linked to O_2 increase)

and / or

nitrogen has increased because

- ammonia reacted with oxygen (to release nitrogen)
- nitrogen is released by bacteria

4

[10]

11. (a) any **three** from:

accept reverse answers if unambiguous
*do **not** accept just different throughout*

3

<u>less</u> / little / not much carbon dioxide **or** give a %age < 1%

more / a lot of nitrogen **or** give 78-80%

(more) / (some) oxygen or give a %age 20-21%
*do **not** accept more "other gases"*

references to pollutant gases in general **or** named examples
e.g. CO, SO_2, NO, NOX etc.

more / some water (vapour)

some / 1% argon
ignore other noble gases

ozone (layer) on earth

(b) any **two** from:

removed carbon dioxide

ignore reference to respiration / photosynthesis unless qualified

released oxygen

caused carbon from carbon dioxide to become locked in sedimentary rocks

the oxygen they produced reacted with methane and ammonia

produced nitrogen (must be linked to fourth point)

*accept correct word / symbol equation for photosynthesis for **2** marks*

*converted / changed CO_2 to oxygen for **2** marks*

2

[5]